
WAC 296-62-07342 1,2-Dibromo-3-chloropropane.

(1) **Scope and application.**

- (a) This section applies to occupational exposure to 1,2-dibromo-3-chloropropane (DBCP).
- (b) This section does not apply to:
 - (i) Exposure to DBCP which results solely from the application and use of DBCP as a pesticide; or
 - (ii) The storage, transportation, distribution or sale of DBCP in intact containers sealed in such a manner as to prevent exposure to DBCP vapors or liquids, except for the requirements of subsections (11), (16) and (17) of this section.

(2) **Definitions applicable to this section:**

- (a) **“Authorized person”** - any person specifically authorized by the employer and whose duties require the person to be present in areas where DBCP is present; and any person entering this area as a designated representative of employees exercising an opportunity to observe employee exposure monitoring.
- (b) **“DBCP”** - 1,2-dibromo-3-chloropropane, Chemical Abstracts Service Registry Number 96-12-8, and includes all forms of DBCP.
- (c) **“Director”** - the director of labor and industries, or his authorized representative.
- (d) **“Emergency”** - any occurrence such as, but not limited to equipment failure, rupture of containers, or failure of control equipment which may, or does, result in unexpected release of DBCP.

(3) **Permissible exposure limits.**

- (a) Inhalation.
 - (i) Time-weighted average limit (TWA). The employer shall assure that no employee is exposed to an airborne concentration in excess of 1 part DBCP per billion part of air (ppb) as an eight-hour time-weighted average.
 - (ii) Ceiling limit. The employer shall assure that no employee is exposed to an airborne concentration in excess of 5 parts DBCP per billion parts of air (ppb) as averaged over any 15 minutes during the working day.
- (b) Dermal and eye exposure. The employer shall assure that no employee is exposed to eye or skin contact with DBCP.

(4) **Notification of use.** Within ten days of the effective date of this section or within ten days following the introduction of DBCP into the workplace, every employer who has a workplace where DBCP is present shall report the following information to the director for each such workplace:

- (a) The address and location of each workplace in which DBCP is present;
- (b) A brief description of each process or operation which may result in employee exposure to DBCP;
- (c) The number of employees engaged in each process or operation who may be exposed to DBCP and an estimate of the frequency and degree of exposure that occurs;

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- (d) A brief description of the employer's safety and health program as it relates to limitation of employee exposure to DBCP.
- (5) **Regulated areas.** The employer shall establish, within each place of employment, regulated areas wherever DBCP concentrations are in excess of the permissible exposure limit.
 - (a) The employer shall limit access to regulated areas to authorized persons.
 - (b) All employees entering or working in a regulated area shall wear respiratory protection in accordance with Table I.
- (6) **Exposure monitoring.**
 - (a) General. Determinations of airborne exposure levels shall be made from air samples that are representative of each employee's exposure to DBCP over an eight-hour period. (For the purposes of this section, employee exposure is that exposure which would occur if the employee were not using a respirator.)
 - (b) Initial. Each employer who has a place of employment in which DBCP is present shall monitor each workplace and work operation to accurately determine the airborne concentrations of DBCP to which employees may be exposed.
 - (c) Frequency.
 - (i) If the monitoring required by this section reveals employee exposures to be below the permissible exposure limits, the employer shall repeat these determinations at least quarterly.
 - (ii) If the monitoring required by this section reveals employee exposure to be in excess of the permissible exposure limits, the employer shall repeat these determinations for each such employee at least monthly. The employer shall continue these monthly determinations until at least two consecutive measurements, taken at least seven days apart, are below the permissible exposure limit, thereafter the employer shall monitor at least quarterly.
 - (d) Additional. Whenever there has been a production process, control or personnel change which may result in any new or additional exposure to DBCP, or whenever the employer has any other reason to suspect a change which may result in new or additional exposure to DBCP, additional monitoring which complies with subsection (6) shall be conducted.
 - (e) Employee notification.
 - (i) Within five working days after the receipt of monitoring results, the employer shall notify each employee in writing of results which represent the employee's exposure.
 - (ii) Whenever the results indicate that employee exposure exceeds the permissible exposure limit, the employer shall include in the written notice a statement that the permissible exposure limit was exceeded and a description of the corrective action being taken to reduce exposure to or below the permissible exposure limits.
 - (f) Accuracy of measurement. The method of measurement shall be accurate, to a confidence level of 95 percent, to within plus or minus 25 percent for concentrations of DBCP at or above the permissible exposure limits.

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(7) Methods of compliance.

- (a) Priority of compliance methods. The employer shall institute engineering and work-practice controls to reduce and maintain employee exposures to DBCP at or below the permissible exposure limit, except to the extent that the employer establishes that such controls are not feasible. Where feasible engineering and work-practice controls are not sufficient to reduce employee exposures to within the permissible exposure limit, the employer shall nonetheless use them to reduce exposures to the lowest level achievable by these controls, and shall supplement them by use of respiratory protection.
- (b) Compliance program.
 - (i) The employer shall establish and implement a written program to reduce employee exposure to DBCP to or below the permissible exposure limit solely by means of engineering and work-practice controls as required by this section.
 - (ii) The written program shall include a detailed schedule for development and implementation of the engineering and work-practice controls. These plans shall be revised at least every six months to reflect the current status of the program.
 - (iii) Written plans for these compliance programs shall be submitted upon request to the director, and shall be available at the worksite for examination and copying by the director, and any affected employee or designated representative of employees.
 - (iv) The employer shall institute and maintain at least the controls described in his most recent written compliance program.

(8) Respiratory protection.

- (a) General. For employees who are required to use respirators under this section, the employer must provide respirators that comply with the requirements of this subsection. Respirators must be used during:
 - (i) Periods necessary to install or implement feasible engineering and work-practice controls;
 - (ii) Maintenance and repair activities for which engineering and work-practice controls are not feasible;
 - (iii) Work operations for which feasible engineering and work-practice controls are not yet sufficient to reduce employee exposure to or below the permissible exposure limit;
 - (iv) Emergencies.
- (b) The employer must establish, implement, and maintain a respiratory protection program as required by chapter 296-842 WAC, except WAC 296-842-13005 and 296-842-14005.
- (c) Respirator selection. The employer must select the appropriate respirator from Table I of this subsection.

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TABLE I RESPIRATORY PROTECTION FOR DBCP	
Concentration Not Greater Than	Respirator Type
(a) 10 ppb:	(i) Any supplied-air respirator.
	(ii) Any self-contained breathing apparatus.
(b) 50 ppb:	(i) Any supplied-air respirator with full facepiece, helmet, or hood.
	(ii) Any self-contained breathing apparatus with full facepiece.
(c) 250 ppb:	(i) A Type C supplied-air respirator operated in pressure-demand or other positive-pressure continuous flow mode.
(d) 500 ppb:	(i) A Type C supplied-air respirator with full facepiece operated in pressure-demand mode with full facepiece.
(e) Greater than 500 ppb or entry into unknown concentrations:	(i) A combination respirator which includes a Type C supplied-air respirator with full facepiece operated in pressure-demand mode and an auxiliary self-contained breathing apparatus.
	(ii) A self-contained breathing apparatus with full facepiece operated in pressure-demand mode.
(f) Firefighting	(i) A self-contained breathing apparatus with full facepiece operated in pressure-demand mode.

(9) **Reserved.**

(10) **Emergency situations.**

- (a) Written plans.
 - (i) A written plan for emergency situations shall be developed for each workplace in which DBCP is present.
 - (ii) Appropriate portions of the plan shall be implemented in the event of an emergency.
- (b) Employees engaged in correcting conditions shall be equipped as required in subsection (11) of this section until the emergency is abated.
- (c) Evacuation. Employees not engaged in correcting the emergency shall be removed and restricted from the area and normal operations in the affected area shall not be resumed until the emergency is abated.
- (d) Alerting employees. Where there is a possibility of employee exposure to DBCP due to the occurrence of an emergency, a general alarm shall be installed and maintained to promptly alert employees of such occurrences.
- (e) Medical surveillance. For any employee exposed to DBCP in an emergency situation, the employer shall provide medical surveillance in accordance with subsection (14) of this section.

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- (f) Exposure monitoring.
 - (i) Following an emergency, the employer shall conduct monitoring which complies with subsection (6) of this section.
 - (ii) In workplaces not normally subject to periodic monitoring, the employer may terminate monitoring when two consecutive measurements indicate exposures below the permissible exposure limit.
- (11) **Protective clothing and equipment.**
 - (a) Provision and use. Where eye or skin contact with liquid or solid DBCP may occur, employers shall provide at no cost to the employee, and assure that employees wear impermeable protective clothing and equipment in accordance with WAC 296-800-160 to protect the area of the body which may come in contact with DBCP.
 - (b) Cleaning and replacement.
 - (i) The employer shall clean, launder, maintain, or replace protective clothing and equipment required by this subsection to maintain their effectiveness. In addition, the employer shall provide clean protective clothing and equipment at least daily to each affected employee.
 - (ii) Removal and storage.
 - (A) The employer shall assure that employees remove DBCP contaminated work clothing only in change rooms provided in accordance with subsection (13) of this section.
 - (B) The employer shall assure that employees promptly remove any protective clothing and equipment which becomes contaminated with DBCP-containing liquids and solids. This clothing shall not be reworn until the DBCP has been removed from the clothing or equipment.
 - (C) The employer shall assure that no employee takes DBCP contaminated protective devices and work clothing out of the change room, except those employees authorized to do so for the purpose of laundering, maintenance, or disposal.
 - (iii) The employer shall assure that DBCP-contaminated protective work clothing and equipment is placed and stored in closed containers which prevent dispersion of DBCP outside the container.
 - (iv) The employer shall inform any person who launders or cleans DBCP-contaminated protective clothing or equipment of the potentially harmful effects of exposure to DBCP.
 - (v) The employer shall assure that the containers of contaminated protective clothing and equipment which are to be removed from the workplace for any reason are labeled in accordance with subsection (16)(c) of this section.
 - (vi) The employer shall prohibit the removal of DBCP from protective clothing and equipment by blowing or shaking.

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(12) Housekeeping.

- (a) Surfaces.
 - (i) All surfaces shall be maintained free of accumulations of DBCP.
 - (ii) Dry sweeping and the use of air for the cleaning of floors and other surfaces where DBCP dust or liquids are found is prohibited.
 - (iii) Where vacuuming methods are selected, either portable units or a permanent system may be used.
 - (A) If a portable unit is selected, the exhaust shall be attached to the general workplace exhaust ventilation system or collected within the vacuum unit, equipped with high efficiency filters or other appropriate means of contaminant removal, so that DBCP is not reintroduced into the workplace air; and
 - (B) Portable vacuum units used to collect DBCP may not be used for other cleaning purposes and shall be labeled as prescribed by subsection (16)(c) of this section.
 - (iv) Cleaning of floors and other contaminated surfaces may not be performed by washing down with a hose, unless a fine spray has first been laid down.
- (b) Liquids. Where DBCP is present in a liquid form, or as a resultant vapor, all containers or vessels containing DBCP shall be enclosed to the maximum extent feasible and tightly covered when not in use.
- (c) Waste disposal. DBCP waste, scrap, debris, bags, containers or equipment, shall be disposed in sealed bags or other closed containers which prevent dispersion of DBCP outside the container.

(13) Hygiene facilities and practices.

- (a) Change rooms. The employer shall provide clean change rooms equipped with storage facilities for street clothes and separate storage facilities for protective clothing and equipment whenever employees are required to wear protective clothing and equipment in accordance with subsections (8), (9) and (11) of this section.
- (b) Showers.
 - (i) The employer shall assure that employees working in the regulated area shower at the end of the work shift.
 - (ii) The employer shall assure that employees whose skin becomes contaminated with DBCP-containing liquids or solids immediately wash or shower to remove any DBCP from the skin.
 - (iii) The employer shall provide shower facilities in accordance with WAC 296-800-230.
- (c) Lunchrooms. The employer shall provide lunchroom facilities which have a temperature controlled, positive pressure, filtered air supply, and which are readily accessible to employees working in regulated areas.

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- (d) Lavatories.
 - (i) The employer shall assure that employees working in the regulated area remove protective clothing and wash their hands and face prior to eating.
 - (ii) The employer shall provide a sufficient number of lavatory facilities which comply with WAC 296-800-230.
 - (e) Prohibition of activities in regulated areas. The employer shall assure that, in regulated areas, food or beverages are not present or consumed, smoking products and implements are not present or used, and cosmetics are not present or applied.
- (14) **Medical surveillance.**
- (a) General. The employer shall institute a program of medical surveillance for each employee who is or will be exposed, without regard to the use of respirators, to DBCP. The employer shall provide each such employee with an opportunity for medical examinations and tests in accordance with this subsection. All medical examinations and procedures shall be performed by or under the supervision of a licensed physician, and shall be provided without cost to the employee.
 - (b) Frequency and content. At the time of initial assignment, annually thereafter, and whenever exposure to DBCP occurs, the employer shall provide a medical examination for employees who work in regulated areas, which includes at least the following:
 - (i) A complete medical and occupational history with emphasis on reproductive history.
 - (ii) A complete physical examination with emphasis on the genito-urinary tract, testicle size, and body habitus including the following tests:
 - (A) Sperm count;
 - (B) Complete urinalysis (U/A);
 - (C) Complete blood count; and
 - (D) Thyroid profile.
 - (iii) A serum specimen shall be obtained and the following determinations made by radioimmunoassay techniques utilizing National Institutes of Health (NIH) specific antigen or one of equivalent sensitivity:
 - (A) Serum multiphasic analysis (SMA 12);
 - (B) Serum follicle stimulating hormone (FSH);
 - (C) Serum luteinizing hormone (LH); and
 - (D) Serum estrogen (females).

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- (iv) Any other tests deemed appropriate by the examining physician.
 - (c) Additional examinations. If the employee for any reason develops signs or symptoms commonly associated with exposure to DBCP, the employer shall provide the employee with a medical examination which shall include those elements considered appropriate by the examining physician.
 - (d) Information provided to the physician. The employer shall provide the following information to the examining physician:
 - (i) A copy of this standard and its appendices;
 - (ii) A description of the affected employee's duties as they relate to the employee's exposure;
 - (iii) The level of DBCP to which the employee is exposed; and
 - (iv) A description of any personal protective equipment used or to be used.
 - (e) Physician's written opinion.
 - (i) For each examination under this section, the employer shall obtain and provide the employee with a written opinion from the examining physician which shall include:
 - (A) The results of the medical tests performed;
 - (B) The physician's opinion as to whether the employee has any detected medical condition which would place the employee at an increased risk of material impairment of health from exposure to DBCP;
 - (C) Any recommended limitations upon the employee's exposure to DBCP or upon the use of protective clothing and equipment such as respirators; and
 - (D) A statement that the employee was informed by the physician of the results of the medical examination, and any medical conditions which require further examination or treatment.
 - (ii) The employer shall instruct the physician not to reveal in the written opinion specific findings or diagnoses unrelated to occupational exposure to DBCP.
 - (iii) The employer shall provide a copy of the written opinion to the affected employee.
 - (f) Emergency situations. If the employee is exposed to DBCP in an emergency situation, the employer shall provide the employee with a sperm count test as soon as practicable, or, if the employee is unable to produce a semen specimen, the hormone tests contained in subsection (14)(b) of this section. The employer shall provide these same tests three months later.
- (15) **Employee information and training.**
- (a) Training program.
 - (i) Within thirty days of the effective date of this standard, the employer shall institute a training program for all employees who may be exposed to DBCP and shall assure their participation in such training program.

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- (ii) The employer shall assure that each employee is informed of the following:
 - (A) The information contained in Appendices A, B and C;
 - (B) The quantity, location, manner of use, release or storage of DBCP and the specific nature of operations which could result in exposure to DBCP as well as any necessary protective steps;
 - (C) The purpose, proper use, limitations, and other training requirements covering respiratory protection as required in chapter 296-62 WAC, Part E;
 - (D) The purpose and description of the medical surveillance program required by subsection (14) of this section; and
 - (E) A review of this standard.
 - (b) Access to training materials.
 - (i) The employer shall make a copy of this standard and its appendices readily available to all affected employees.
 - (ii) The employer shall provide, upon request, all materials relating to the employee information and training program to the director.
- (16) **Signs and labels.**
 - (a) General.
 - (i) The employer may use labels or signs required by other statutes, regulations, or ordinances in addition to or in combination with, signs and labels required by this subsection.
 - (ii) The employer shall assure that no statement appears on or near any sign or label required by this subsection which contradicts or detracts from the required sign or label.
 - (b) Signs.
 - (i) The employer shall post signs to clearly indicate all work areas where DBCP may be present. These signs shall bear the legend:

DANGER
1,2-Dibromo-3-chloropropane

(Insert appropriate trade or common names)

CANCER HAZARD
AUTHORIZED PERSONNEL ONLY

- (ii) Where airborne concentrations of DBCP exceed the permissible exposure limits, the signs shall bear the additional legend:

RESPIRATOR REQUIRED

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- (c) Labels.
 - (i) The employer shall assure that precautionary labels are affixed to all containers of DBCP and of products containing DBCP, and that the labels remain affixed when the DBCP or products containing DBCP are sold, distributed, or otherwise leave the employer's workplace. Where DBCP or products containing DBCP are sold, distributed or otherwise leave the employer's workplace bearing appropriate labels required by EPA under the regulations in 40 CFR Part 162, the labels required by this subsection need not be affixed.
 - (ii) The employer shall assure that the precautionary labels required by this subsection are readily visible and legible. The labels shall bear the following legend:

DANGER
1,2-Dibromo-3-chloropropane
CANCER HAZARD

(17) Recordkeeping.

- (a) Exposure monitoring.
 - (i) The employer shall establish and maintain an accurate record of all monitoring required by subsection (6) of this section.
 - (ii) This record shall include:
 - (A) The dates, number, duration and results of each of the samples taken, including a description of the sampling procedure used to determine representative employee exposure;
 - (B) A description of the sampling and analytical methods used;
 - (C) Type of respiratory worn, if any; and
 - (D) Name, Social Security number, and job classification of the employee monitored and of all other employees whose exposure the measurement is intended to represent.
 - (iii) The employer shall maintain this record for at least forty years or the duration of employment plus twenty years, whichever is longer.
- (b) Medical surveillance.
 - (i) The employer shall establish and maintain an accurate record for each employee subject to medical surveillance required by subsection (14) of this section.
 - (ii) This record shall include:
 - (A) The name and Social Security number of the employee;
 - (B) A copy of the physician's written opinion;
 - (C) Any employee medical complaints related to exposure to DBCP;

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- (D) A copy of the information provided the physician as required by subsection (14)(c) of this section; and
 - (E) A copy of the employee's medical and work history.
 - (iii) The employer shall maintain this record for at least forty years or the duration of employment plus twenty years, whichever is longer.
 - (c) Availability.
 - (i) The employer shall assure that all records required to be maintained by this section be made available upon request to the director for examination and copying.
 - (ii) Employee exposure monitoring records and employee medical records required by this subsection shall be provided upon request to employees' designated representatives and the assistant director in accordance with chapter 296-802 WAC.
 - (d) Transfer of records.
 - (i) If the employer ceases to do business, the successor employer shall receive and retain all records required to be maintained by this section for the prescribed period.
 - (ii) If the employer ceases to do business and there is no successor employer to receive and retain the records for the prescribed period, the employer shall transmit these records by mail to the director.
 - (iii) At the expiration of the retention period for the records required to be maintained under this section, the employer shall transmit these records by mail to the director.
 - (iv) The employer shall also comply with any additional requirements involving transfer of records set forth in chapter 296-802 WAC.
- (18) **Observation of monitoring.**
- (a) Employee observation. The employer shall provide affected employees, or their designated representatives, an opportunity to observe any monitoring of employee exposure to DBCP conducted under subsection (6) of this section.
 - (b) Observation procedures.
 - (i) Whenever observation of the measuring or monitoring of employee exposure to DBCP requires entry into an area where the use of protective clothing or equipment is required, the employer shall provide the observer with personal protective clothing or equipment required to be worn by employees working in the area, assure the use of such clothing and equipment, and require the observer to comply with all other applicable safety and health procedures.
 - (ii) Without interfering with the monitoring or measurement, observers shall be entitled to:

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- (A) Receive an explanation of the measurement procedures;
- (B) Observe all steps related to the measurement of airborne concentrations of DBCP performed at the place of exposure; and
- (C) Record the results obtained.

(19) **Appendices.** The information contained in the appendices is not intended, by itself, to create any additional obligations not otherwise imposed or to detract from any existing obligation.

[Statutory Authority: RCW 49.17.010, .040, .050, and .060. 05-03-093 (Order 04-41), § 296-62-07306, filed 01/18/05, effective 03/01/05. Statutory Authority: RCW 49.17.010, .040, .050, and .060. 04-10-026 (Order 03-04) § 296-62-07342, filed 04/27/04, effective 08/01/04. Statutory Authority: RCW 49.17.010, .40, .050, and .060. 03-18-090 (Order 03-15), § 296-62-07342, filed 09/02/03, effective 11/01/03. Statutory Authority: RCW 49.17.010, .040, .050. 01-11-038 (Order 99-36), § 296-62-07342, filed 05/09/01, effective 09/01/01. Statutory Authority: RCW 49.17.010, .040, .050. 99-10 (Order 98-10), § 296-62-07342, filed 05/04/99, effective 09/01/99. Statutory Authority: Chapter 49.17 RCW. 96-09-030 (Order 96-01), § 296-62-07342, filed 4/10/96, effective 6/1/96; 88-11-021 (Order 88-04), § 296-62-07342, filed 5/11/88.]

WAC 296-62-07343 Appendix A--Substance safety data sheet for DBCP.

(1) **Substance identification.**

- (a) Synonyms and trades names: DBCP; Dibromochloropropane; Fumazone (Dow Chemical Company TM); Nemaflume; Nemaflon (Shell Chemical Co. TM); Nemaset; BBC 12; and OS 1879.
- (b) Permissible exposure:
 - (i) Airborne. 1 part DBCP vapor per billion parts of air (1 ppb); time-weighted average (TWA) for an eight-hour workday.
 - (ii) Dermal. Eye contact and skin contact with DBCP are prohibited.
- (c) Appearance and odor: Technical grade DBCP is a dense yellow or amber liquid with a pungent odor. It may also appear in granular form, or blended in varying concentrations with other liquids.
- (d) Uses: DBCP is used to control nematodes, very small worm-like plant parasites, on crops including cotton, soybeans, fruits, nuts, vegetables and ornamentals.

(2) **Health hazard data.**

- (a) Routes of entry: Employees may be exposed:
 - (i) Through inhalation (breathing);
 - (ii) Through ingestion (swallowing);
 - (iii) Skin contact; and
 - (iv) Eye contact.
- (b) Effects of exposure:
 - (i) Acute exposure. DBCP may cause drowsiness, irritation of the eyes, nose, throat and skin, nausea and vomiting. In addition, overexposure may cause damage to the lungs, liver or kidneys.

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- (ii) Chronic exposure. Prolonged or repeated exposure to DBCP has been shown to cause sterility in humans. It also has been shown to produce cancer and sterility in laboratory animals and has been determined to constitute an increased risk of cancer in people.
- (iii) Reporting signs and symptoms. If you develop any of the above signs or symptoms that you think are caused by exposure to DBCP, you should inform your employer.

(3) Emergency first-aid procedures.

- (a) Eye exposure. If DBCP liquid or dust containing DBCP gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with DBCP.
- (b) Skin exposure. If DBCP liquids or dusts containing DBCP get on your skin, immediately wash using soap or mild detergent and water. If DBCP liquids or dusts containing DBCP penetrate through your clothing, remove the clothing immediately and wash. If irritation is present after washing get medical attention.
- (c) Breathing. If you or any person breathe in large amounts of DBCP, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Do not use mouth-to-mouth. Keep the affected person warm and at rest. Get medical attention as soon as possible.
- (d) Swallowing. When DBCP has been swallowed and the person is conscious, give the person large amounts of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.
- (e) Rescue. Notify someone. Put into effect the established emergency rescue procedures. Know the locations of the emergency rescue equipment before the need arises.

(4) Respirators and protective clothing.

- (a) Respirators. You may be required to wear a respirator in emergencies and while your employer is in the process of reducing DBCP exposures through engineering controls. If respirators are worn, they must have a label issued by the National Institute for Occupational Safety and Health (NIOSH) under the provisions of 42 CFR part 84 stating that the respirators have been certified for use with organic vapors. For effective protection, a respirator must fit your face and head snugly. The respirator should not be loosened or removed in work situations where its use is required. Respirators must not be loosened or removed in work situations where their use is required.
- (b) Protective clothing. When working with DBCP you must wear for your protection impermeable work clothing provided by your employer. (Standard rubber and neoprene protective clothing do not offer adequate protection). DBCP must never be allowed to remain on the skin. Clothing and shoes must not be allowed to become contaminated with DBCP, and if they do, they must be promptly removed and not worn again until completely free of DBCP. Turn in impermeable clothing that has developed leaks for repair or replacement.
- (c) Eye protection. You must wear splashproof safety goggles where there is any possibility of DBCP liquid or dust contacting your eyes.

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(5) Precautions for safe use, handling, and storage.

- (a) DBCP must be stored in tightly closed containers in a cool, well-ventilated area.
- (b) If your work clothing may have become contaminated with DBCP, or liquids or dusts containing DBCP, you must change into uncontaminated clothing before leaving the work premises.
- (c) You must promptly remove any protective clothing that becomes contaminated with DBCP. This clothing must not be reworn until the DBCP is removed from the clothing.
- (d) If your skin becomes contaminated with DBCP, you must immediately and thoroughly wash or shower with soap or mild detergent and water to remove any DBCP from your skin.
- (e) You must not keep food, beverages, cosmetics, or smoking materials, nor eat or smoke, in regulated areas.
- (f) If you work in a regulated area, you must wash your hands thoroughly with soap or mild detergent and water, before eating, smoking or using toilet facilities.
- (g) If you work in a regulated area, you must remove any protective equipment or clothing before leaving the regulated area.
- (h) Ask your supervisor where DBCP is used in your work area and for any additional safety and health rules.

(6) Access to information.

- (a) Each year, your employer is required to inform you of the information contained in this substance safety data sheet for DBCP. In addition, your employer must instruct you in the safe use of DBCP, emergency procedures, and the correct use of protective equipment.
- (b) Your employer is required to determine whether you are being exposed to DBCP. You or your representative have the right to observe employee exposure measurements and to record the result obtained. Your employer is required to inform you of your exposure. If your employer determines that you are being overexposed, they are required to inform you of the actions which are being taken to reduce your exposure.
- (c) Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure and medical data for at least forty years or the duration of your employment plus twenty years, whichever is longer.
- (d) Your employer is required to release exposure and medical records to you, your physician, or other individual designated by you upon your written request.

[Statutory Authority: RCW 49.17.010, .040, .050. 99-10 (Order 98-10) § 296-62-07343, filed 05/04/99, effective 09/01/99.] Statutory Authority: Chapter 49.17 RCW. 94-15-096 (Order 94-07), § 296-62-07343, filed 7/20/94, effective 9/20/94; 88-11-021 (Order 88-04), § 296-62-07343, filed 5/11/88.]

WAC 296-62-07344 Appendix B--Substance technical guidelines for DBCP.

(1) Physical and chemical data.

- (a) Substance identification.

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- (i) Synonyms: 1,2-dibromo-3-chloropropane; DBCP, Fumazone; Nema fume; Nemagon; Nemaset; BBC 12; OS 1879. DBCP is also included in agricultural pesticides and fumigants which include the phrase “Nema____, in their name.
 - (ii) Formula: $C_3H_5Br_2Cl$.
 - (iii) Molecular weight: 236.
 - (b) Physical data:
 - (i) Boiling point (760 mm HG): 195C (383F)
 - (ii) Specific gravity (water = 1): 2.093.
 - (iii) Vapor density (air = 1 at boiling point of DBCP): Data not available.
 - (iv) Melting point: 6C (43F).
 - (v) Vapor pressure at 20C (68F): 0.8 mm HG
 - (vi) Solubility in water: 1000 ppm.
 - (vii) Evaporation rate (Butyl Acetate = 1): Very much less than 1.
 - (c) Appearance and odor: Dense yellow or amber liquid with a pungent odor at high concentrations. Any detectable odor of DBCP indicates overexposure.
- (2) **Fire explosion and reactivity hazard data.**
- (a) Fire.
 - (i) Flash point: 170F (77C)
 - (ii) Autoignition temperature: Data not available.
 - (iii) Flammable limits in air, percent by volume: Data not available.
 - (iv) Extinguishing media: Carbon dioxide, dry chemical.
 - (v) Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
 - (vi) Unusual fire and explosion hazards: None known.
 - (vii) For purposes of complying with the requirements of WAC 296-24-330, liquid DBCP is classified as a Class III A combustible liquid.
 - (viii) For the purpose of complying with chapter 296-24 WAC Part L, the classification of hazardous locations as described in article 500 of the National Electrical Code for DBCP shall be Class I, Group D.

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- (ix) For the purpose of compliance with WAC 296-24-592, DBCP is classified as a Class B fire hazard.
 - (x) For the purpose of compliance with WAC 296-24-230, locations classified as hazardous locations due to the presence of DBCP shall be Class I, Group D.
 - (xi) Sources of ignition are prohibited where DBCP presents a fire or explosion hazard.
- (b) Reactivity.
 - (i) Conditions contributing to instability: None known.
 - (ii) Incompatibilities: Reacts with chemically active metals, such as aluminum, magnesium and tin alloys.
 - (iii) Hazardous decomposition products: Toxic gases and vapors (such as HBr, HCl and carbon monoxide) may be released in a fire involving DBCP.
 - (iv) Special precautions: DBCP will attack some rubber materials and coatings.
- (3) **Spill, leak and disposal procedures.**
 - (a) If DBCP is spilled or leaked, the following steps should be taken:
 - (i) The area should be evacuated at once and re-entered only after thorough ventilation.
 - (ii) Ventilate area of spill or leak.
 - (iii) If in liquid form, collect for reclamation or absorb in paper, vermiculite, dry sand, earth or similar material.
 - (iv) If in solid form, collect spilled material in the most convenient and safe manner for reclamation or for disposal.
 - (b) Persons not wearing protective equipment must be restricted from areas of spills or leaks until cleanup has been completed.
 - (c) Waste disposal methods:
 - (i) For small quantities of liquid DBCP, absorb on paper towels, remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be reclaimed or collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. If liquid DBCP is absorbed in vermiculite, dry sand, earth or similar material and placed in sealed containers it may be disposed of in a state-approved sanitary landfill.
 - (ii) If in solid form, for small quantities, place on paper towels, remove to a safe place (such as a fume hood) and burn. Large quantities may be reclaimed. However, if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. DBCP in solid form may also be disposed in a state-approved sanitary landfill.

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(4) Monitoring and measurement procedures.

- (a) Exposure above the permissible exposure limit.
 - (i) Eight hour exposure evaluation: Measurements taken for the purpose of determining employee exposure under this section are best taken so that the average eight-hour exposure may be determined from a single eight-hour sample or two four-hour samples. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).
 - (ii) Monitoring techniques: The sampling and analysis under this section may be performed by collecting the DBCP vapor on petroleum based charcoal absorption tubes with subsequent chemical analyses. The method of measurement chosen should determine the concentration of airborne DBCP at the permissible exposure limit to an accuracy of plus or minus twenty-five percent. If charcoal tubes are used, a total volume of ten liters should be collected at a flow rate of 50 cc per minute for each tube. Analyze the resultant samples as you would samples of halogenated solvent.
- (b) Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

(5) Protective clothing. Employees should be required to wear appropriate protective clothing to prevent any possibility of skin contact with DBCP. Because DBCP is absorbed through the skin, it is important to prevent skin contact with both liquid and solid forms of DBCP. Protective clothing should include impermeable coveralls or similar fullbody work clothing, gloves, headcoverings, and workshoes or shoe coverings. Standard rubber and neoprene gloves do not offer adequate protection and should not be relied upon to keep DBCP off the skin. DBCP should never be allowed to remain on the skin. Clothing and shoes should not be allowed to become contaminated with the material; and if they do, they should be promptly removed and not worn again until completely free of the material. Any protective clothing which has developed leaks or is otherwise found to be defective should be repaired or replaced. Employees should also be required to wear splashproof safety goggles where there is any possibility of DBCP contacting the eyes.

(6) Housekeeping and hygiene facilities.

- (a) The workplace must be kept clean, orderly and in a sanitary condition.
- (b) Dry sweeping and the use of compressed air is unsafe for the cleaning of floors and other surfaces where DBCP dust or liquids are found. To minimize the contamination of air with dust, vacuuming with either portable or permanent systems must be used. If a portable unit is selected, the exhaust must be attached to the general workplace exhaust ventilation system, or collected within the vacuum unit equipped with high efficiency filters or other appropriate means of contamination removal and not used for other purposes. Units used to collect DBCP must be labeled.
- (c) Adequate washing facilities with hot and cold water must be provided, and maintained in a sanitary condition. Suitable cleansing agents should also be provided to assure the effective removal of DBCP from the skin.
- (d) Change or dressing rooms with individual clothes storage facilities must be provided to prevent the contamination of street clothes with DBCP. Because of the hazardous nature of DBCP, contaminated protective clothing must be stored in closed containers for cleaning or disposal.

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(7) **Miscellaneous precautions.**

- (a) Store DBCP in tightly closed containers in a cool, well ventilated area.
- (b) Use of supplied-air suits or other impervious clothing (such as acid suits) may be necessary to prevent skin contact with DBCP. Supplied-air suits should be selected, used, and maintained under the supervision of persons knowledgeable in the limitations and potential life-endangering characteristics of supplied-air suits.
- (c) The use of air-conditioned suits may be necessary in warmer climates.
- (d) Advise employees of all areas and operations where exposure to DBCP could occur.

(8) **Common operations.** Common operations in which exposure to DBCP is likely to occur are: During its production; and during its formulation into pesticides and fumigants.

[Statutory Authority: Chapter 49.17 RCW. 91-24-017 (Order 91-07), § 296-62-07344, filed 11/22/91, effective 12/24/91; 88-11-021 (Order 88-04), § 296-62-07344, filed 5/11/88.]

WAC 296-62-07346 Appendix C--Medical surveillance guidelines for DBCP.

(1) **Route of entry.**

- (a) Inhalation;
- (b) Skin absorption.

(2) **Toxicology.** Recent data collected on workers involved in the manufacture and formulation of DBCP has shown that DBCP can cause sterility at very low levels of exposure. This finding is supported by studies showing that DBCP causes sterility in animals. Chronic exposure to DBCP resulted in pronounced necrotic action on the parenchymatous organs (i.e., liver, kidney, spleen) and on the testicles of rats at concentrations as low as 5 ppm. Rats that were chronically exposed to DBCP also showed changes in the composition of the blood, showing low RBC, hemoglobin, and WBC, and high reticulocyte levels as well as functional hepatic disturbance, manifesting itself in a long prothrombin time. Reznik et al., noted a single dose of 100 mg produced profound depression of the nervous system of rats. Their condition gradually improved. Acute exposure also resulted in the destruction of the sex gland activity of male rats as well as causing changes in the estrous cycle in female rats. Animal studies have also associated DBCP with an increased incidence of carcinoma. Olson, et al., orally administered DBCP to rats and mice five times per week at experimentally predetermined maximally tolerated doses and at half those doses. As early as ten weeks after initiation of treatment, DBCP induced a high incidence of squamous cell carcinomas of the stomach with metastases in both species. DBCP also induced mammary adenocarcinomas in the female rats at both dose levels.

(3) **Signs and symptoms.**

- (a) Inhalation: Nausea, eye irritation, conjunctivitis, respiratory irritation, pulmonary congestion or edema, CNS depression with apathy, sluggishness, and ataxia.
- (b) Dermal: Erythema or inflammation and dermatitis on repeated exposure.

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(4) Special tests.

- (a) Semen analysis: The following information excerpted from the document "Evaluation of Testicular Function," submitted by the Corporate Medical Department of the Shell Oil Company (exhibit 39-3), may be useful to physicians conducting the medical surveillance program. In performing semen analyses certain minimal but specific criteria should be met:
 - (i) It is recommended that a minimum of three valid semen analyses be obtained in order to make a determination of an individual's average sperm count.
 - (ii) A period of sexual abstinence is necessary prior to the collection of each masturbatory sample. It is recommended that intercourse or masturbation be performed 48 hours before the actual specimen collection. A period of 48 hours of abstinence would follow; then the masturbatory sample would be collected.
 - (iii) Each semen specimen should be collected in a clean, widemouthed, glass jar (not necessarily pre-sterilized) in a manner designated by the examining physician. Any part of the seminal fluid exam should be initialed only after liquifaction is complete, i.e., 30 to 45 minutes after collection.
 - (iv) Semen volume should be measured to the nearest 1/10 of a cubic centimeter.
 - (v) Sperm density should be determined using routine techniques involving the use of a white cell pipette and a hemocytometer chamber. The immobilizing fluid most effective and most easily obtained for this process is distilled water.
 - (vi) Thin, dry smears of the semen should be made for a morphologic classification of the sperm forms and should be stained with either hematoxylin or the more difficult, yet more precise, Papanicolaou technique. Also of importance to record is obvious sperm agglutination, pyospermia, delayed liquifaction (greater than 30 minutes), and hyperviscosity. In addition, pH, using nitrazine paper, should be determined.
 - (vii) A total morphology evaluation should include percentages of the following:
 - (A) Normal (oval) forms,
 - (B) Tapered forms,
 - (C) Amorphous forms (include large and small sperm shapes),
 - (D) Duplicated (either heads or tails) forms, and
 - (E) Immature forms.
 - (viii) Each sample should be evaluated for sperm viability (percent viable sperm moving at the time of examination) as well as sperm motility (subjective characterization of "purposeful forward sperm progression" of the majority of those viable sperm analyzed) within two hours after collection, ideally by the same or equally qualified examiner.
- (b) Serum determinations: The following serum determinations should be performed by radiomuno-assay techniques using National Institutes of Health (NIH) specific antigen or antigen preparations of equivalent sensitivity:

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- (i) Serum follicle stimulating hormone (FSH),
 - (ii) Serum luteinizing hormone (LH), and
 - (iii) Serum total estrogen (females only).
- (5) **Treatment.** Remove from exposure immediately, give oxygen or artificial resuscitation if indicated. Contaminated clothing and shoes should be removed immediately. Flush eyes and wash contaminated skin. If swallowed and the person is conscious, induce vomiting. Recovery from mild exposures is usually rapid and complete.
- (6) **Surveillance and preventive considerations.**
 - (a) Other considerations. DBCP can cause both acute and chronic effects. It is important that the physician become familiar with the operating conditions in which exposure to DBCP occurs. Those with respiratory disorders may not tolerate the wearing of negative pressure respirators.
 - (b) Surveillance and screening. Medical histories and laboratory examinations are required for each employee subject to exposure to DBCP. The employer should screen employees for history of certain medical conditions (listed below) which might place the employee at increased risk from exposure:
 - (i) Liver disease. The primary site of biotransformation and detoxification of DBCP is the liver. Liver dysfunctions likely to inhibit the conjugation reactions will tend to promote the toxic actions of DBCP. These precautions should be considered before exposing persons with impaired liver function to DBCP.
 - (ii) Renal disease. Because DBCP has been associated with injury to the kidney it is important that special consideration be given to those with possible impairment of renal function.
 - (iii) Skin disease. DBCP can penetrate the skin and can cause erythema on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of DBCP.
 - (iv) Blood dyscrasias. DBCP has been shown to decrease the content of erythrocytes, hemoglobin, and leukocytes in the blood, as well as increase the prothrombin time. Persons with existing blood disorders may be more susceptible to the effects of DBCP.
 - (v) Reproductive disorders. Animal studies have associated DBCP with various effects on the reproductive organs. Among these effects are atrophy of the testicles and changes in the estrous cycle. Persons with pre-existing reproductive disorders may be at increased risk to these effects of DBCP.
- (7) **References.**
 - (a) Reznik, Ya. B. and Sprinchan, G. K.: Experimental Data on the Gonadotoxic effect of Nemagon, Gig. Sanit., (6), 1975, pp. 101-102, (translated from Russian).
 - (b) Faydysh, E. V., Rakhmatullaev, N. N. and Varshavskii, V. A.: The Cytotoxic Action of Nemagon in a Subacute Experiment, Med. Zh. Uzbekistana, (No. 1), 1970, pp. 64-65, (translated from Russian).
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(e) Torkelson, T. R. et al.: Toxicologic Investigations of 1,2-Dibromo-3-chloropropane, *Toxicology and Applied Pharmacology*, 3, 1961 pp. 545-559.

[Statutory Authority: Chapter 49.17 RCW. 88-11-021 (Order 88-04), § 296-62-07346, filed 5/11/88.]

WAC 296-62-07354 Appendices--Inorganic arsenic. The information in Appendices A, B, and C is not intended, by itself, to create any additional obligations not otherwise imposed by WAC 296-62-07347 nor detract from existing obligation.

- (1) **Appendix A--Inorganic arsenic substance information sheet.**
 - (a) Substance identification.
 - (i) Substance. Inorganic arsenic.
 - (ii) Definition. Copper acetoarsenite, arsenic and all inorganic compounds containing arsenic except arsine, measured as arsenic (As).
 - (iii) Permissible exposure limit. Ten micrograms per cubic meter of air as determined as an average over an 8 hour period. No employee may be exposed to any skin or eye contact with arsenic trichloride or to skin or eye contact likely to cause skin or eye irritation.
 - (iv) Regulated areas. Only employees authorized by your employer should enter a regulated area.
 - (b) Health hazard data.
 - (i) Comments. The health hazard of inorganic arsenic is high.
 - (ii) Ways in which the chemical affects your body. Exposure to airborne concentrations of inorganic arsenic may cause lung cancer, and can be a skin irritant. Inorganic arsenic may also affect your body if swallowed. One compound in particular, arsenic trichloride, is especially dangerous because it can be absorbed readily through the skin. Because inorganic arsenic is a poison, you should wash your hands thoroughly prior to eating or smoking.
 - (c) Personal protective equipment and clothing.
 - (i) Respirators. Respirators will be provided by the employer at no cost to employees for routine use if the employer is in the process of implementing engineering and work-practice controls or where engineering and work-practice controls are not feasible or insufficient. Respirators must be worn for nonroutine activities or in emergency situations where there is likely to be exposure to levels of inorganic arsenic in excess of the permissible exposure limit. Since how well the respirator fits is very important, the employer is required to conduct fit tests to make sure the respirator seals properly when worn. These tests are simple and rapid and will be explained during training sessions.
 - (ii) Protective clothing. If work is in a regulated area, the employer is required to provide at no cost to employees, and it must be worn, appropriate, clean, protective clothing and equipment. The purpose of this equipment is to prevent the employee from taking home

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arsenic-contaminated dust and to protect the body from repeated skin contact with inorganic arsenic likely to cause skin irritation. This clothing shall include such items as coveralls or similar full-body clothing, gloves, shoes or coverlets, and aprons. Protective equipment should include face shields or vented goggles, where eye irritation may occur.

- (d) Hygiene facilities and practices.
 - (i) The employer shall ensure that employees do not eat, drink, smoke, chew gum or tobacco, or apply cosmetics in the regulated area, except that drinking water is permitted. If work is in a regulated area, the employer is required to provide lunchrooms or other areas for these purposes.
 - (ii) If work is in a regulated area, the employer is required to provide showers, washing facilities, and change rooms. The employer shall ensure that employees wash faces and hands before eating and shower at the end of the work shift. Do not take used protective clothing out of change rooms without the employer's permission. The employer is required to provide for laundering or cleaning of the protective clothing.
- (e) Signs and labels. The employer is required to post warning signs and labels for employee protection. Signs must be posted in regulated areas. The signs must warn that a cancer hazard is present, that only authorized employees may enter the area, and that no smoking or eating is allowed, and that respirators must be worn.
- (f) Medical examinations. If exposure to arsenic is over the action level ($5 \mu\text{g}/\text{m}^3$) (including all persons working in regulated areas) at least 30 days per year, or employees have been exposed to arsenic for more than 10 years over the action level, the employer is required to provide employees with a medical examination. The examination shall be every 6 months for employees over 45 years old or with more than 10 years exposure over the action level and annually for other covered employees. The medical examination must include a medical history; a chest x-ray (annual requirement only); skin examination; and nasal examination. The examining physician will provide a written opinion to the employer containing the results of the medical exams. Employees should also receive a copy of this opinion. The physician must not tell the employer any conditions he detects unrelated to occupational exposure to arsenic but must tell employees those conditions.
- (g) Observation of monitoring. The employer is required to monitor employee exposure to arsenic and employees or their representatives are entitled to observe the monitoring procedure. Employees are entitled to receive an explanation of the measurement procedure, and to record the results obtained. When the monitoring procedure is taking place in an area where respirators or personal protective clothing and equipment are required to be worn, employees must also be provided with and must wear the protective clothing and equipment.
- (h) Access to records. Employees or their representatives are entitled to records of employee exposure to inorganic arsenic upon request to the employer. Employee medical examination records can be furnished to employees' physician if employees request the employer to provide them.
- (i) Training and notification. Additional information on all of these items plus training as to hazards of exposure to inorganic arsenic and the engineering and work-practice controls associated with employees' jobs will also be provided by the employer. If employees are exposed over the permissible exposure limit, the employer must inform employees of that fact and the actions to be taken to reduce employee exposure.

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(2) **Appendix B--Substance technical guidelines.** Arsenic, arsenic trioxide, arsenic trichloride (3 examples)

(a) Physical and chemical properties

(i) Arsenic (metal)

- (A) Formula: As
- (B) Appearance: Gray metal
- (C) Melting point: Sublimes without melting at 613C
- (D) Specific gravity: ($H_2O = 1$):5.73.
- (E) Solubility in water: Insoluble

(ii) Arsenic trioxide

- (A) Formula: As_2O_3 , (As_4O_6).
- (B) Appearance: White powder
- (C) Melting point: 315C
- (D) Specific gravity: ($H_2O = 1$):3.74
- (E) Solubility in water: 3.7 grams in 100cc of water at 20C

(iii) Arsenic trichloride (liquid)(Trichloride)

- (A) Formula: $AsCl_3$
- (B) Appearance: Colorless or pale yellow liquid
- (C) Melting point: -8.5C
- (D) Boiling point: 130.2C
- (E) Specific gravity ($H_2O = 1$): 2.16 at 20C
- (F) Vapor Pressure: 10mm Hg at 23.5C.
- (G) Solubility in water: Decomposes in water.

(b) Fire, explosion, and reactivity data.

- (i) Fire: Arsenic trioxide and arsenic trichloride are nonflammable.
- (ii) Reactivity:

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- (A) Conditions contributing to instability: Heat.
 - (B) Incompatibility: Hydrogen gas can react with inorganic arsenic to form the highly toxic gas arsine.
 - (c) Monitoring and measurement procedures.
 - (i) Samples collected should be full shift (at least 7 hours) samples. Sampling should be done using a personal sampling pump at a flow rate of 2 liters per minute. Samples should be collected on 0.8 micrometer pore size membrane filter (37mm diameter). Volatile arsenicals such as arsenic trichloride can be most easily collected in a midget bubbler filled with 15 ml. of 0.1 N NaOH.
 - (ii) The method of sampling and analysis should have an accuracy of not less than ± 25 percent (with a confidence limit of 95 percent) for 10 micrograms per cubic meter of air ($10 \mu\text{g}/\text{m}^3$) and ± 35 percent (with a confidence limit of 95 percent) for concentrations of inorganic arsenic between 5 and $10 \mu\text{g}/\text{m}^3$.
- (3) **Appendix C--Medical surveillance guidelines.**
- (a) General.
 - (i) Medical examinations are to be provided for all employees exposed to levels of inorganic arsenic above the action level ($5 \mu\text{g}/\text{m}^3$) for at least 30 days per year (which would include among others, all employees, who work in regulated areas). Examinations are also to be provided to all employees who have had 10 years or more exposure above the action level for more than 30 days per year while working for the present or predecessor employer though they may no longer be exposed above the level.
 - (ii) An initial medical examination is to be provided to all such employees by December 1, 1978. In addition, an initial medical examination is to be provided to all employees who are first assigned to areas in which worker exposure will probably exceed $5 \mu\text{g}/\text{m}^3$ (after the effective date of this standard) at the time of initial assignment. In addition to its immediate diagnostic usefulness the initial examination will provide a baseline for comparing future test results. The initial examination must include as a minimum the following elements:
 - (A) A work and medical history, including a smoking history, and presence and degree of respiratory symptoms such as breathlessness, cough, sputum production, and wheezing;
 - (B) A 14-inch by 17-inch posterior-anterior chest x-ray and an International Labor Office UICC/Cincinnati (ILO U/C) rating;
 - (C) A nasal and skin examination; and
 - (D) Other examinations which the physician believes appropriate because of the employee's exposure to inorganic arsenic or because of required respirator use.
 - (iii) Periodic examinations are also to be provided to the employees listed above. The periodic examinations shall be given annually for those covered employees 45 years of age or less with fewer than 10 years employment in areas where employee exposure exceeds the action level ($5 \mu\text{g}/\text{m}^3$). Periodic examinations need not include sputum cytology and only an updated medical history is required.

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- (iv) Periodic examinations for other covered employees, shall be provided every 6 months. These examinations shall include all tests required in the initial examination, except that the medical history need only be updated.
- (v) The examination contents are minimum requirements. Additional tests such as lateral and oblique x-rays or pulmonary function tests may be useful. For workers exposed to 3 arsenicals, copper acetoarsenite, potassium arsenite, or sodium arsenite, which are associated with lymphatic cancer, the examination should also include palpation of superficial lymph nodes and complete blood count.
- (b) Noncarcinogenic effects.
 - (i) The WISHA standard is based on minimizing risk of exposed workers dying of lung cancer from exposure to inorganic arsenic. It will also minimize skin cancer from such exposures.
 - (ii) The following three sections quoted from "Occupational Diseases: A Guide to Their Recognition," Revised Edition, June 1977, National Institute for Occupational Safety and Health is included to provide information on the nonneoplastic effects of exposure to inorganic arsenic. Such effects should not occur if the WISHA standards are followed.
 - (A) Local--Trivalent arsenic compounds are corrosive to the skin. Brief contact has no effect but prolonged contact results in a local hyperemia and later vesicular or pustular eruption. The moist mucous membranes are most sensitive to the irritant action. Conjunctiva, moist and macerated areas of skin, the eyelids, the angles of the ears, nose, mouth, and respiratory mucosa are also vulnerable to the irritant effects. The wrists are common sites of dermatitis, as are the genitalia if personal hygiene is poor. Perforations of the nasal septum may occur. Arsenic trioxide and pentoxide are capable of producing skin sensitization and contact dermatitis. Arsenic is also capable of producing keratoses, especially of the palms and soles.
 - (B) Systemic.
 - (I) The acute toxic effects of arsenic are generally seen following ingestion of inorganic arsenical compounds. This rarely occurs in an industrial setting. Symptoms develop within 1/2 to 4 hours following ingestion and are usually characterized by constriction of the throat followed by dysphagia, epigastric pain, vomiting, and watery diarrhea. Blood may appear in vomitus and stools. If the amount ingested is sufficiently high, shock may develop due to severe fluid loss, and death may ensue in 24 hours. If the acute effects are survived, exfoliative dermatitis and peripheral neuritis may develop.
 - (II) Cases of acute arsenical poisoning due to inhalation are exceedingly rare in industry. When it does occur, respiratory tract symptoms - cough, chest pain, dyspnea - giddiness, headache, and extreme general weakness precede gastrointestinal symptoms. The acute toxic symptoms of trivalent arsenical poisoning are due to severe inflammation of the mucous membranes and greatly increased permeability of the blood capillaries.
 - (III) Chronic arsenical poisoning due to ingestion is rare and generally confined to patients taking prescribed medications. However, it can be a concomitant of inhaled inorganic arsenic from swallowed sputum and improper eating habits. Symptoms are weight loss, nausea and diarrhea

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alternating with constipation, pigmentation and eruption of the skin, loss of hair, and peripheral neuritis. Chronic hepatitis and cirrhosis have been described. Polyneuritis may be the salient feature, but more frequently there are numbness and parasthenias of “glove and stocking” distribution. The skin lesions are usually melanotic and keratotic and may occasionally take the form of an intradermal cancer of the squamous cell type, but without infiltrative properties. Horizontal white lines (striations) on the fingernails and toenails are commonly seen in chronic arsenical poisoning and are considered to be a diagnostic accompaniment of arsenical polyneuritis.

- (IV) Inhalation of inorganic arsenic compounds is the most common cause of chronic poisoning in the industrial situation. This condition is divided into three phases based on signs and symptoms.
- (V) First phase: The worker complains of weakness, loss of appetite, some nausea, occasional vomiting, a sense of heaviness in the stomach, and some diarrhea.
- (VI) Second phase: The worker complains of conjunctivitis, a catarrhal state of the mucous membranes of the nose, larynx, and respiratory passage. Coryza, hoarseness, and mild tracheobronchitis may occur. Perforation of the nasal septum is common, and is probably the most typical lesion of the upper respiratory tract in occupational exposure to arsenical dust. Skin lesions, eczematoid and allergic in type, are common.
- (VII) Third phase: The worker complains of symptoms of peripheral neuritis, initially of hands and feet, which is essentially sensory. In more severe cases, motor paralyzes occur; the first muscles affected are usually the toe extensors and the peronei. In only the most severe cases will paralysis of flexor muscles of the feet or of the extensor muscles of hands occur.
- (VIII) Liver damage from chronic arsenical poisoning is still debated, and as yet the question is unanswered. In cases of chronic and acute arsenical poisoning, toxic effects to the myocardium have been reported based on EKG changes. These findings, however, are now largely discounted and the EKG changes are ascribed to electrolyte disturbances concomitant with arsenicalism. Inhalation of arsenic trioxide and other inorganic arsenical dusts does not give rise to radiological evidence or pneumoconiosis. Arsenic does have a depressant effect upon the bone marrow, with disturbances of both erythropoiesis and myelopoiesis.

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[Statutory Authority: RCW 49.17.010, .040, .050. 99-17-094 (Order 99-01, § 296-62-07347, filed 08/17/99, effective 12/01/99.
Statutory Authority: RCW 49.17.010, [49.17].040 and [49.17].050. 98-02-030, § 296-62-07354, filed 12/31/97, effective 1/31/98.
Statutory Authority: Chapter 49.17 RCW. 90-20-091 (Order 90-14), § 296-62-07354, filed 10/1/90, effective 11/15/90.]